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HYDROLOGIC CONSIDERATIONS IN FEDERAL COAL LEASING

by

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Abstract

The Bureau of Land Management is faced with the task of leasing hundreds of millions of tons of Federal coal over the next few years. New legislation and departmental and agency policy directives dictate that water resources values will be carefully considered and accounted for before leasing can occur. BLM hydrologists, with assistance from hydrologists of the US Geological Survey, have designed and implemented a system for collecting and interpreting the necessary hydrologic data from previously "ungaged basins", predicting the potential impacts of surface mining and associated leasing activities, and finally making a recommendation to the land manager relative to the water resource.

The BLM initiated in 1975 a program to provide the land manager with an assessment of the mined-land rehabilitation potential and recommendations for reclamation methods and procedures for potential coal lease areas. This program is responsible for supplying hydrologic input to the coal leasing process and for

improving our knowledge of hydrologic process response functions on coal lands in eight states. The program dovetails closely with the USGS's coal hydrology program.

An example is given of a hydrologic assessment in support of coal leasing in the Warrior Coal Field, Alabama.

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The Bureau of Land Management (BLM) is faced with the task of leasing hundreds of millions of tons of Federal coal over the next few years. Federal coal leasing under the Interior Secretary's new Federal Coal Management Program is scheduled to begin in January 1981.¹ Land-use planning and regional coal activity planning are now underway in eight Federal coal production regions (Figure 1).

Approximately 40% of the total Federal coal reserves are found in the eastern states. The 845,170 acres of Federal mineral estate which contain this coal are managed by the BLM. However, only a very minor fraction of the associated land surface is managed by BLM. Table 1 gives a breakdown of surface management responsibilities in the thirteen eastern states which have Federal coal.

The Role of the Bureau of Land Management in the Federal Coal Program

The BLM has the responsibility for leasing Federal coal under the guidelines set by the Secretary of Interior in June 1979. Before leasing can occur, a

detailed planning analysis must be accomplished. Figure 2 gives a very simplified version of the coal leasing flow chart. The actual leasing process involves some forty steps between the inception of the land use plan and the sale of leases.

First BLM prepares a land-use plan for the area in question. Water resources values and development/protection opportunities are identified by the BLM hydrologist and then weighed against those of other resources. The framework and flow chart for this process is shown in Figure 3. The BLM hydrologists' responsibility in this planning exercise is to optimize water resources values. New legislation and agency policy directives dictate that several water resources variables will be carefully considered and accounted for before leasing is allowed to progress. Water resources management objectives will include such considerations as: protection of hydrologically sensitive areas, erosion and sediment prevention and reduction, water-quality management, floodplain and water yield management, and water rights assertion.

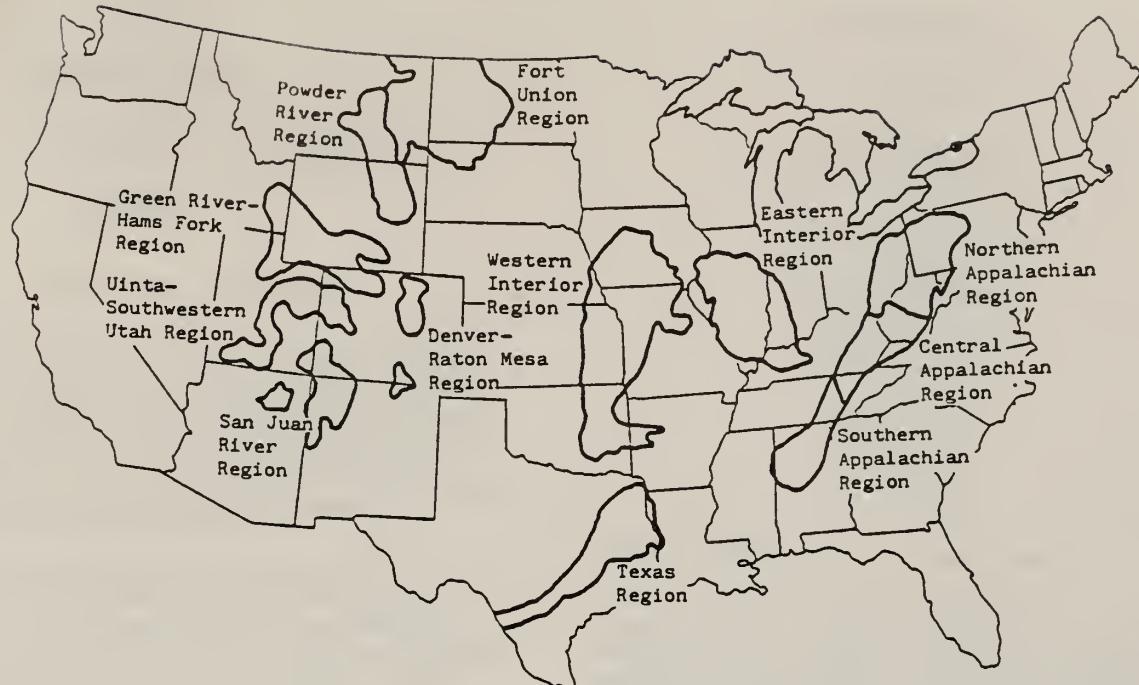


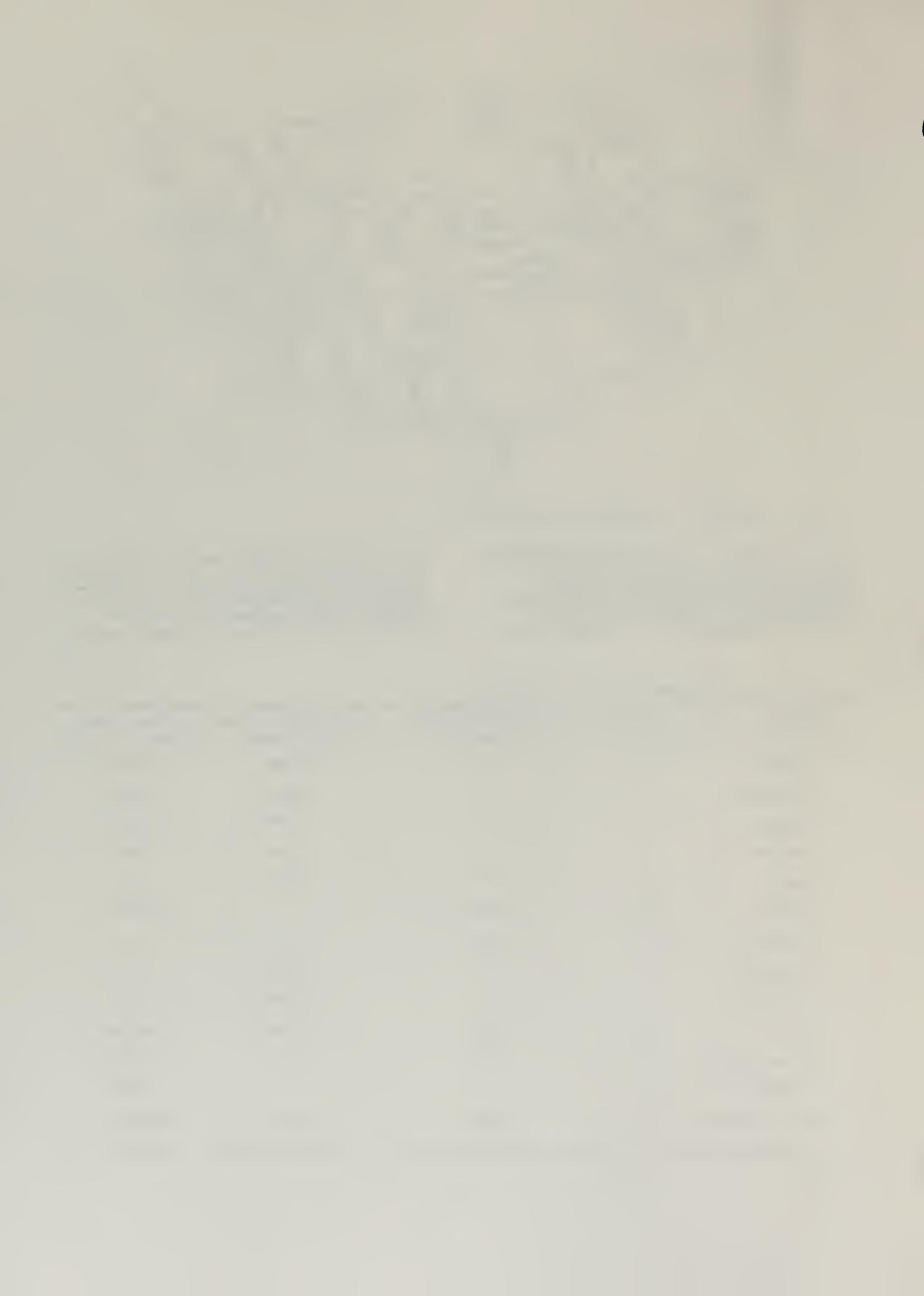
Figure 1. Federal coal production regions in the U.S.

After all resources management recommendations have been made, a conflict resolution process is conducted so that all resource conflicts are resolved or somehow mitigated. At this stage it becomes incumbent upon the BLM hydrologist to effectively demonstrate to the land manager those

water resource values which would be lost as a result of a certain land-use decision. The result of the conflict resolution process is a land-use decision that provides for the best possible multiple resource management scenario. For planning efforts in Federal coal regions, another

Table 1. Federal coal ownership in the eastern U.S.

State	% of Total	Acres Under State Ownership	Acres Under Private Ownership	Acres Under Fed. Own.
Alabama	33	--	91,780	183,412
Arkansas	4	--	1,228	35,360
Illinois	11	--	3,347	92,152
Indiana	3	--	118	24,657
Iowa	<1	--	1,320	--
Kentucky	20	39,416	--	127,510
Maryland	<1	3,662	--	--
Michigan	<1	--	1,225	--
Missouri	1	--	6,779	--
Ohio	11	23,442	200	66,592
Pennsylvania	2	6,767	--	8,104
Virginia	4	--	--	31,649
West Virginia	11	<u>7,591</u>	--	<u>88,859</u>
Total Acres		80,878	105,997	658,295



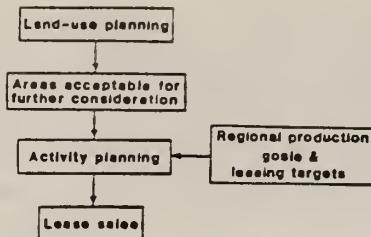


Figure 2. Federal coal leasing process.

product of this effort is the identification of areas acceptable for further leasing consideration. These are lands that have passed through all the environmental and resource conflict "screens". These areas can now be studied specifically to determine what tracts can be offered for lease and how the area must be reclaimed to satisfy post-mining land-use objectives.

The specific process which terminates in the issuing of coal leases is called coal activity planning and is represented as a flow chart in Figure 4. In this process potential lease tracts are delineated, subjected to a resource analysis, and ranked in order of leasing priority. An environmental impact statement is then written for the entire coal region. The impact statement is based on the tract selections, tract ranking, and the lease schedule. Both tract-specific and cumulative impacts are analysed. From a hydrologic standpoint, the cumulative impact analysis is important because more than one tract could be leased and developed within the same drainage basin.

Once a decision has been made to lease a tract to industry, the BLM has a further responsibility to attach stipulations to the lease agreement to ensure compliance with all applicable resource management and environmental regulations. BLM's

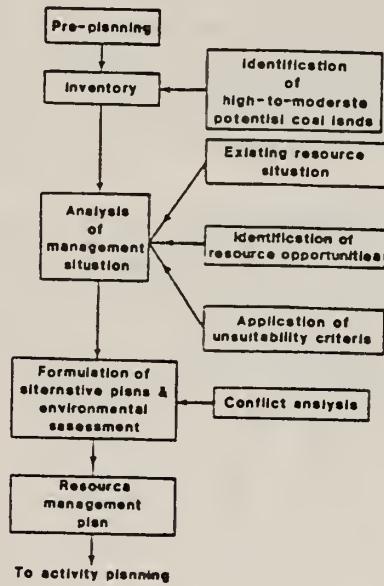


Figure 3. Land-use planning process of the Bureau of Land Management.

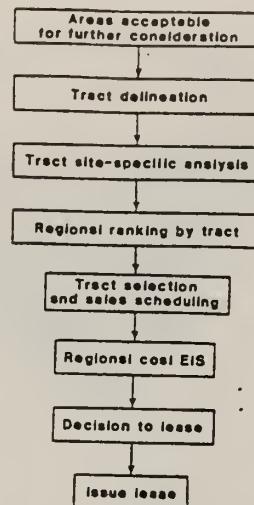


Figure 4. Coal activity planning steps.

sister agency, the Office of Surface Mining, then takes the lead in approving the mining plan and ensuring bond compliance. BLM has one additional responsibility to ensure that the land is returned to the desired post-mining land use, which will include the water resources recommendations which were included in the original land-use decision.

Hydrologic Investigations In Support of Coal Leasing

In 1974 the BLM, in response to a need for more detailed information on hydrology, soils, overburden characteristics, and reclamation potential, initiated the Energy Minerals Rehabilitation Inventory and Analysis (EMRIA) program. For the past several years the EMRIA program has funded a significant coal hydrology effort responsible for increasing knowledge of hydrologic processes on Federal coal lands in the eight Federal coal production regions. The EMRIA program has been the principal source of hydrologic data used in coal activity planning.

The EMRIA program was redesigned in 1980 to provide the maximum benefits for the new Federal Coal Management Program. With the technical assistance of the U.S. Geological Survey's Water Resources Division, BLM is conducting hydrologic studies on potential coal lease lands in Montana, North Dakota, Wyoming, Colorado, Utah, New Mexico, Oklahoma and Alabama. The hydrologic studies involve the following five categories:

1. Reconnaissance hydrologic investigations and watershed characterizations
2. Area hydrologic investigations
3. Site-specific hydrologic surveys
4. Small basin hydrologic modeling
5. Topical hydrologic studies

Reconnaissance studies are performed in large river basins containing Federal coal. They are designed to provide baseline hydrologic data where no such data existed previously. Area hydrologic investigations are conducted on smaller basins (10 to 50 square miles) where the BLM feels that some coal

leasing will likely occur. Site-specific hydrological surveys are performed on delineated coal lease tracts or on specific reclamation study areas and may also be conducted in connection with a site-specific study of unsuitability criteria. Topical hydrologic studies have been initiated in some areas to answer specific questions about hydrologic process-response functions and to improve our general knowledge of the hydrology of the coal regions.

The small watershed hydrologic modeling project is a joint effort between BLM and the Water Resources Division of the Geological Survey. This modeling effort will provide BLM hydrologists with the capability of predicting water resources impacts from coal development. Twenty study basins, used for developing and testing the model, have been established in the eight Federal coal regions. The model represents a tool that will permit transferring data from gaged basins to ungaged basins and that will also assist in making predictions about hydrologic impacts of surface mining. There are insufficient time and funds to conduct traditional hydrologic studies on all potential coal lease tracts. By applying the model to coal lease areas, the BLM hydrologist will then be in a position to make interpretations and supportable recommendations to the land manager.

Hydrologic Assessment of the Warrior Coal Field, Alabama

In Alabama, the Federal coal reserves having the greatest potential for leasing in the near future are in the Warrior Coal Field in the north central part of the state (Figure 5). The two areas of study shown in Figure 5 were selected because surface mining in the Warrior coal field occurs in two geologically and hydrologically distinct areas.

In 1976 the BLM and USGS established a network of hydrologic monitoring stations in four basins, two in each of the two study areas. These basins, shown in Figure 6, were chosen on the basis of their high concentration of Federal minerals and their high probability of being mined in the near future. The basins were paired in two lithologically different areas: the Pottsville sandstone (Bear and Blue Creeks) and the unconsolidated Coker sand and gravel formation (Turkey and Yellow Creeks). The geologic variations between these two areas result in large differences in hydrologic characteristics.²

Hydrologic data are being collected in the four basins to provide baseline information to aid in assessing the potential impacts surface mining will have on water resources. Puente et al. (1980) have reported on the findings of the first two years of the study.² These data, together with other historical data from the Warrior coal field, were used to develop predictive relationships utilized by the BLM in its site-specific analysis of potential coal lease tracts. These predictive tools were "quick and dirty" methods needed immediately to prepare for the first round of coal leasing in Alabama in 1981. Specifically, basin size, geology, and land-use characteristics were used in a regression analysis to predict pre-mining discharge from one to two square mile basins within potential coal lease tracts. Furthermore, based on regression analysis of historical data in the Warrior coal field, stream pH, specific conductance, hardness, iron, manganese, and sulfate

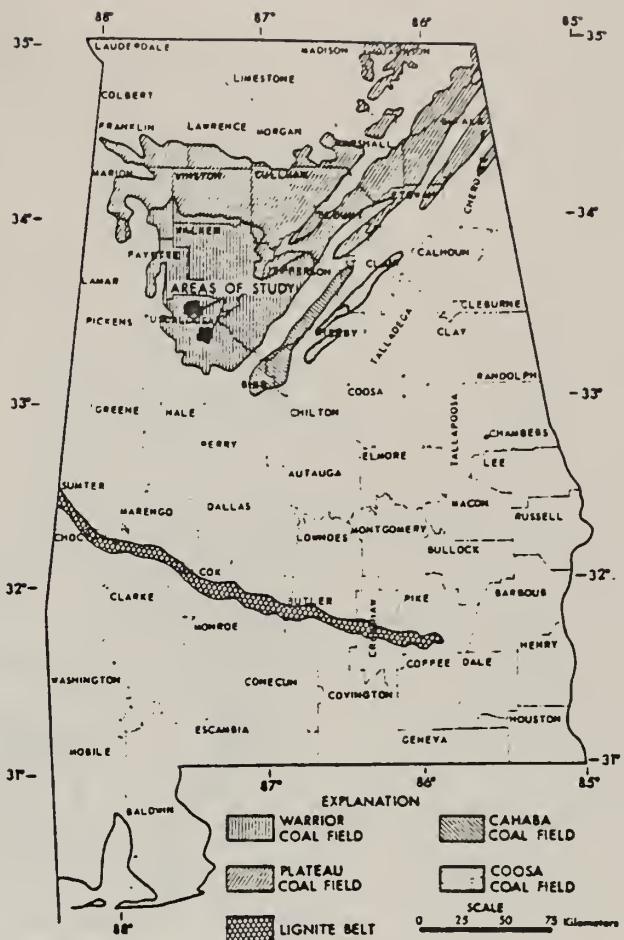
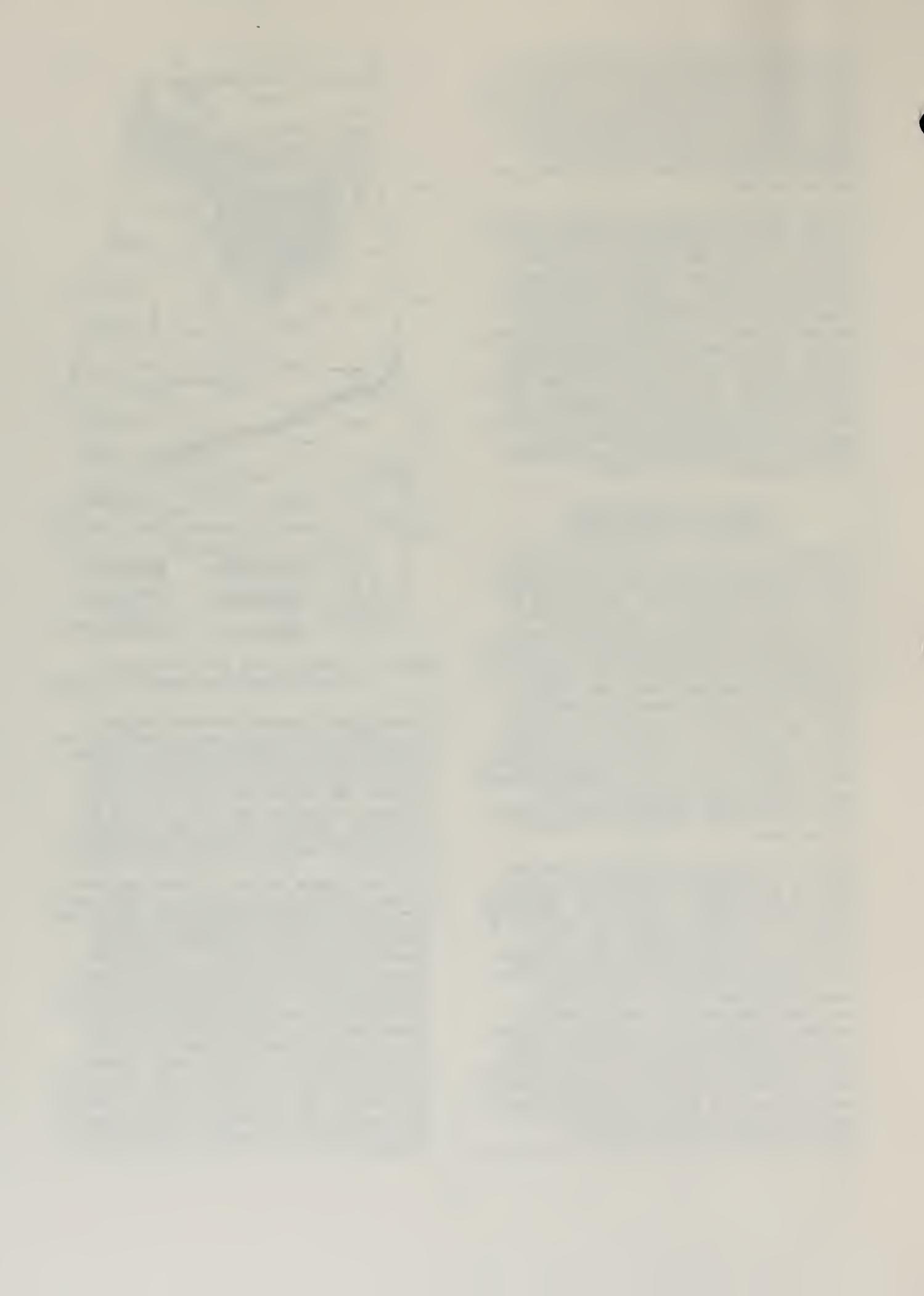


Figure 5. Hydrologic study areas, Warrior Coal Field, Alabama (after Puente et al., 1980).

concentrations, suspended sediment, and total recoverable aluminum percentage were estimated from information on the estimated discharge, geology, age of mining, percentage of basin mined, and distance downstream from the centroid of mining activity. For the present, this is the type of hydrologic information that lease decisions are based upon. Estimates of hydrologic parameters have been consistently falling within 80% of observed values, whenever such checks were possible.

For future leasing activity in Alabama and other states, the BLM intends to employ the small watershed hydrologic model developed by the USGS to give estimates of hydrologic parameters for ungaged basins and to assist in predicting hydrologic impacts from surface mining.^{3,4} Data from the four study basins in the Warrior coal field are currently being used by the USGS to calibrate the hydrologic model. Calibration results are initially encouraging. The high frequency of runoff events, which can exceed 40 in one year, should allow for adequate model calibration. Current model runs have been producing annual discharge estimates within 95% of observed flows in test basins. This degree of accuracy is very encouraging and indicates that hydrologic modeling could be a very useful predictive tool for hydrologic assessments of Federal coal leasing in the Warrior coal field and similar coal regions of the eastern U.S.



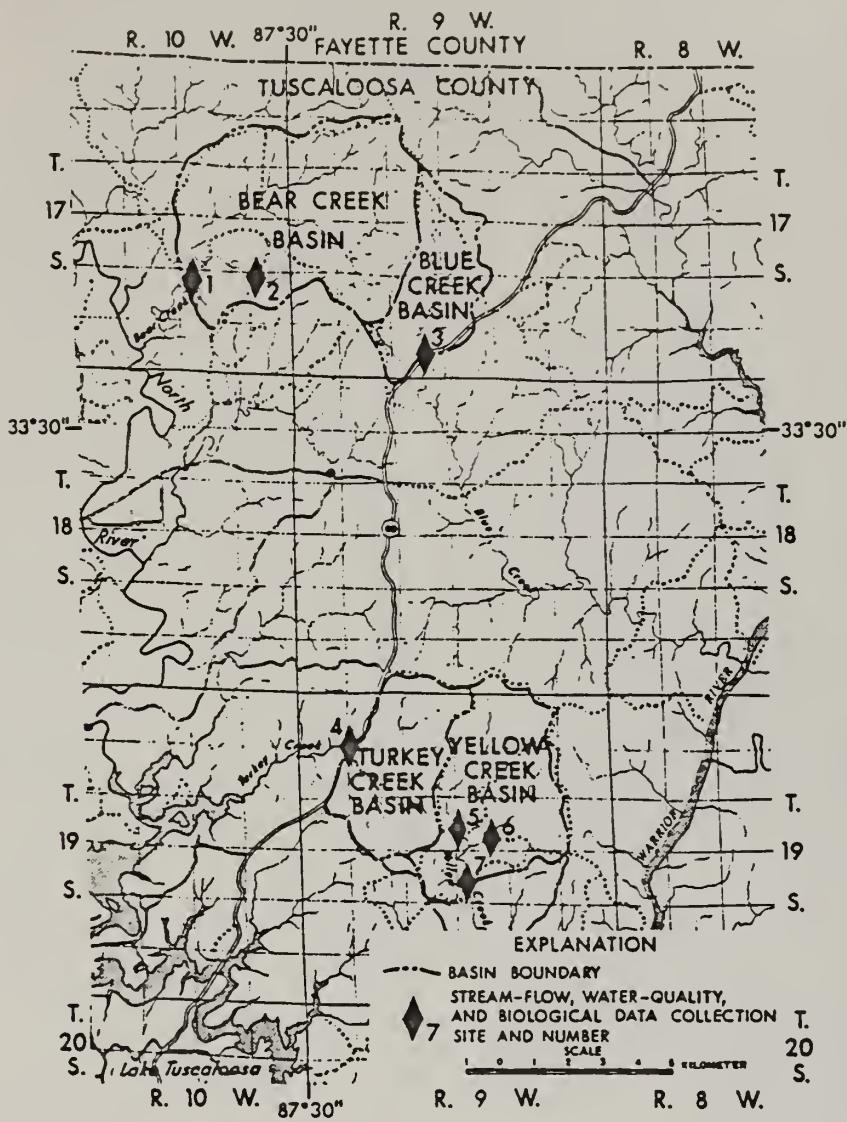


Figure 6. The Bear, Blue, Turkey, and Yellow Creek Hydrologic Study Basins, Warrior Coal Field, north central Alabama (after Puente et al., 1980).

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